



## How is post-industrial decline associated with the geography of physical activity? Evidence from the Health Survey for England



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### ABSTRACT

In recent decades, the prevalence of physical activity has declined considerably in many developed countries, which has been related to rising levels of obesity and several weight-related medical conditions, such as coronary heart disease. There is evidence that areas exhibiting particularly low levels of physical activity have undergone a strong transition away from employment in physically demanding occupations. It is proposed that such processes of deindustrialisation may be causally linked to unexplained geographical disparities in physical activity. This study investigates how geographical variations in deindustrialisation are associated with current levels of physical activity across different activity domains and relevant macro-economic time periods in England. The analysis includes data on 27,414 adults from the Health Survey for England 2006 and 2008 who reported total, occupational, domestic, recreational and walking activity. Based on employment change in industries associated with heavy manual work, a local measurement of industrial decline was developed, covering the period 1841–2001. We applied a multilevel modelling approach to study associations between industrial decline and physical activity. Results indicate that the process of deindustrialisation appears to be associated with patterns of physical activity and that this is independent of household income. The effects observed were generally similar for men and women. However, the nature of the association differed across areas, time periods and employment types; in particular, residents of districts characterised by a history of manufacturing and mining employment had increased odds of reporting low activity levels. We conclude that post-industrial change may be a factor in explaining present-day variations in physical activity, emphasising the plausible impact of inherited cultures and regional identities on health related behaviours.

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### Introduction

Achieving a health-promoting weekly energy expenditure from physical activity (PA) of about 1000 kcal equates to just 1 h of moderate walking five days a week (Warburton, Nicol, & Bredin, 2006a, 2006b). However, in Europe more than 65% of the adult population is insufficiently active, and this has been related to increasing levels of obesity and related diseases such as diabetes, heart disease and several forms of cancer (World Health Organisation, 2006). Compared to many other European countries, the proportion of sedentary residents in the UK is relatively high and the proportion of the population being sufficiently active is low (Sjöström, Oja, Hagströmer, Smith, & Bauman, 2006). The average person walks less than a mile per day, and between 1975

and 2009 the average annual walking distance decreased by 68 miles, a decline of 26% (Department for Transport, 2010; Fox & Hillsdon, 2007).

Recently, Stamatakis, Ekelund, and Wareham (2007) investigated temporal trends in PA in England and showed that levels of occupational PA have decreased significantly between 1991 and 2004. There was a small increase in recreational PA across the country during this period, but this was not pronounced in men from manual social classes, lower income households, and those from non-white ethnic backgrounds (Stamatakis & Chaudhury, 2008). This is of particular concern given that these groups are the ones who are most vulnerable to the loss of PA from their occupation (Popham & Mitchell, 2007).

Using data from the Health Survey for England (HSE) 2003, Allender, Foster, and Boxer (2008) have shown that occupational activity significantly contributes to overall PA in English adults.

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Further, the contribution of occupational activity is shown to be socially patterned, with both men and women in manual occupations being more likely to meet the government recommended PA guidelines than their non-manual counterparts. Those in manual occupations, however, show lower levels of recreational activity (Kirk & Rhodes, 2011).

It has been argued that the lower prevalence of recreational activity in manual classes could persist even after a transition to less physically demanding occupations (Jones & Bentham, 2009), resulting in low levels of overall PA in individuals and communities who have been particularly affected by industrial transitions. Observed decreases in occupational PA in England, along with many other European countries, have been related to industrial decline and technical progress including processes of automation and computerisation. A consequence has been a considerably reduced need for heavy manual work, even in areas where employment in heavy industries has remained relatively high (Bazen & Thirlwall, 1997). In England, the demand for manual employment has long been in decline and over the last century this has been particularly so in the agricultural sector (–92%), manufacturing (–51%) and the mining industry (–90%) (Southall & Great Britain Historical GIS Project, 2009).

There is overwhelming evidence that health outcomes and behaviours, including PA, mirror levels of socio-economic deprivation and inequality in ways that cannot be solely explained by the individual characteristics of the population under study (e.g. Cleland et al., 2010; Doran, Drever, & Whitehead, 2004; Krieger, 2001). Doran, Drever, and Whitehead (2006) for example showed that mining, manufacturing and other industrial areas had lower life expectancies than predicted by their level of deprivation. Related to such observations, there is some evidence that processes associated with industrial decline may directly impact these health and related behaviours. For example, Mitchell, Gleave, Bartley, Wiggins, and Joshi (2000) investigated the effect of deindustrialisation on self-reported physical health in Great Britain between 1981 and 1991. They found that residents living in areas that were highly dependent on industrial employment and that had experienced high levels of employment decline were more likely to report physical ill-health compared to those where the effects of industrial decline were less severe.

In terms of PA, prior research has shown that residents of more northerly and urban districts that have undergone a particular strong transition from industrial to postindustrial economies are more likely to report low levels of PA than their more southerly and rural counterparts (Blaxter, 1990; Ellis, Grimsley, Goyder, Blank, & Peters, 2007; Rind & Jones, 2011). Indeed we have previously described substantial geographical variations in recreational PA in England (Rind & Jones, 2011). More recently we have developed a conceptual framework that describes how unexplained components of these variations might be associated with industrial decline in parts of the country (Rind & Jones, *in press*). In that framework, we illustrate how decreases in occupational PA might be coupled with other local changes including the loss of social networks, rising levels of social fragmentation, and degradation of the physical environment to create obesogenic environments in areas that have experienced losses in employment in manual occupations. We note the need to empirically search for empirical evidence regarding the potential mechanisms outlined in the framework.

Industrial decline catalysed the transformation of occupational structures, the widening of health inequalities and has been one of the most incisive contextual large-scale drivers of social change in modern history. However, there has been rather little research attempting to assess how patterns of deindustrialisation may affect observed variations in the prevalence

of PA across the different activity domains. This study has been undertaken to investigate associations between individual and contextual correlates of PA related to the context of industrial decline, and in doing so to test for evidence of the processes outlined in the conceptual framework developed in Rind and Jones (*in press*). We hypothesise that levels of PA are likely to be low in areas where there has been a history of high employment as well as high decline in occupations associated with heavy manual work. We further hypothesise the relationship between deindustrialisation and PA to vary according to macro-economic change. We hope that the outcomes of this study will contribute to a better understanding of where and how factors related to changes in socio-economic conditions affect levels of PA across the different activity domains.

## Methods

### Data

The primary data sources for this study were the Health Surveys for England (HSE) 2006 and 2008 (NHS Information Centre, 2011), as well as the Great Britain Historical GIS project (Gregory & Southall, 1998; Southall, 2011). Subsequently, the use of these sources to provide the outcomes and exposure measures analysed is described.

### Physical activity

The HSE is an annual survey drawn from a nationally representative general population sample that includes data on several indicators of health and related behaviours. The full sampling methodology and the derivation of the PA variables is described elsewhere (Craig & Mindell, 2008; Craig, Mindell, & Hirani, 2009). Briefly, a random sample of core addresses are selected from the Postcode Address File and households are sampled proportionately across the nine Government Office regions of England. For the survey conducted in 2006, 14,142 adults aged 16 and over were interviewed at their homes, and 15,102 were interviewed for the HSE 2008. All PA measures recorded and used for this study were based on self-report. The HSE samples for 2006 and 2008 include comparable measurements of total, occupational, domestic, recreational, and walking activities, and these two years were combined to provide the outcome dataset for this analysis. For this study, all participants aged 16 and above providing information for the five activity domains were identified, and individual records were obtained.

The outcome variables provided in the HSE dataset covered the frequency and intensity of activity undertaken in five different domains of PA (total PA, walking, occupational, domestic, and recreational PA) based on reported activity spells of at least 30 min duration undertaken over the last four weeks prior to interview. Total PA in both HSE surveys was measured as the number of days per week of any moderate and vigorous activity. Overall activity levels for each respondent were categorised as 'less active' (<1 day/week), 'moderately active' (1–4 days/week), or 'highly active' (5 or more days/week). Levels of walking activity were classified accordingly based on the reported number of days over the last 4 weeks respondents walked at a fast or brisk pace.

The intensity of reported activities for the other three domains was classified based on MET (metabolic equivalent) intensities categorised by the Compendium of Physical Activities (Ainsworth et al., 2000). One MET is considered a resting metabolic rate obtained during quiet sitting. If respondents did not report any activity of at least 30 min duration in a domain they were categorised as 'inactive'. The classification of occupational activity levels

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